



Overview of Space Station Hardware Available



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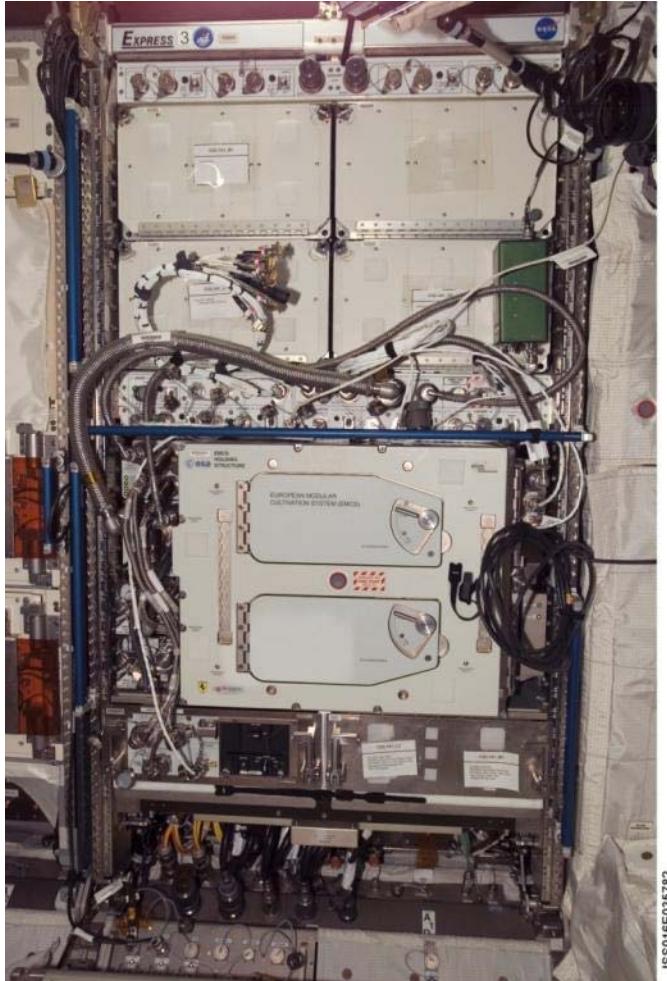
for
The Microgravity Biomaterials Workshop

at the
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EXPRESS Rack



EXPRESS Rack 3 with European Modular Cultivation System operating in Columbus Module

- EXpedite the PRocessing of Experiments to Space Station (EXPRESS) rack is a multi-use facility which provides standard interfaces and resources for Middeck Locker-type and International Subrack Interface Standard (ISIS)Payloads
 - 28Vdc power
 - Ethernet, RS422 , Analog, Discrete
 - Air and Water (2 locations per rack) Cooling
 - NTSC Video
 - Vacuum Exhaust (1 location per rack)
 - Nitrogen Supply (1 location per rack)
- Eight flight racks
- Trainer Racks at JSC and MSFC to support crew and ground training
- Functional Checkout Unit (FCU) to support payload testing at MSFC



EXPRESS Payload Resources

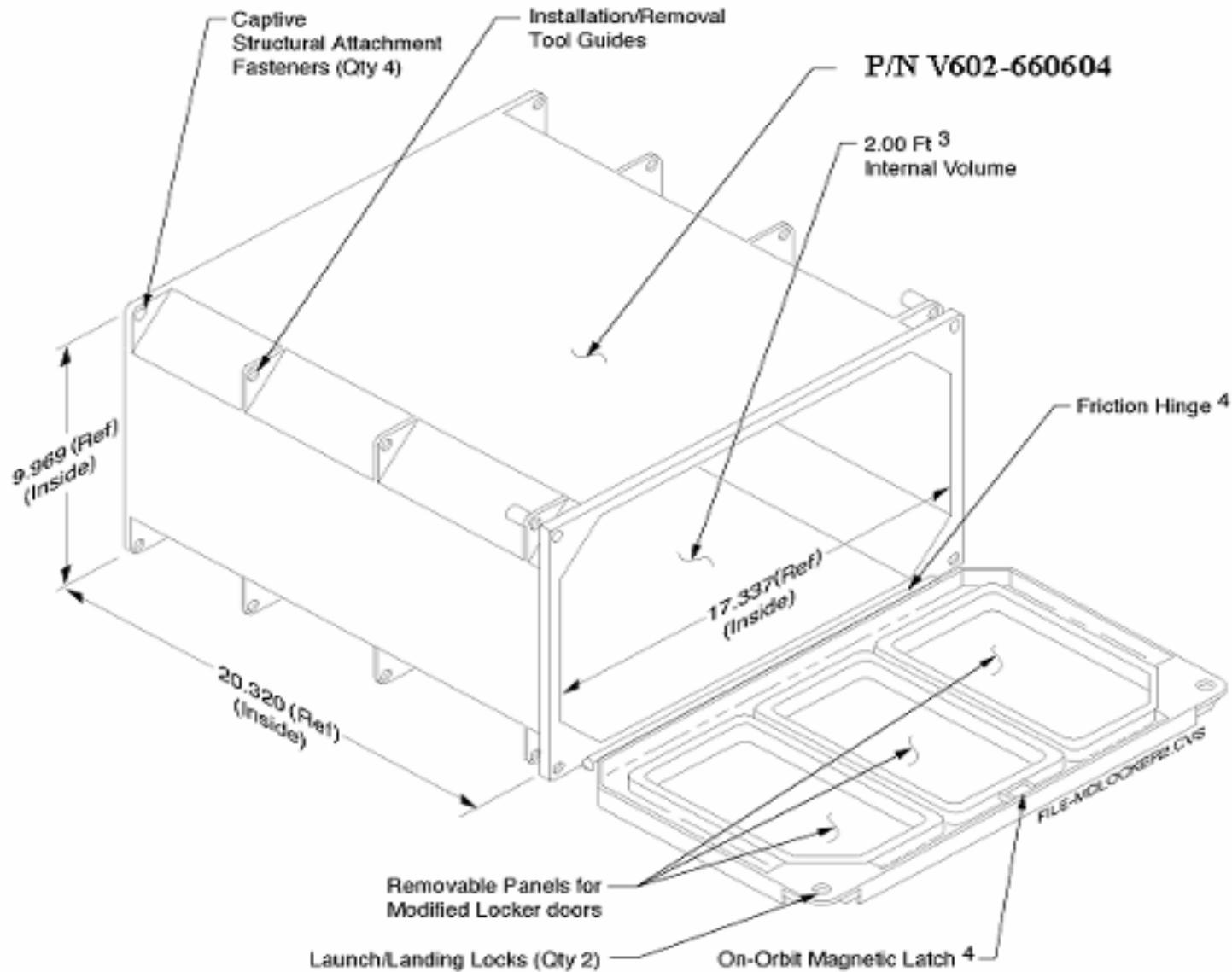


Resource	Amount per Payload Position	
	Locker	ISIS Drawer
Structural Attachment	Attachment to Rack per IDD •Mass constraint launch vehicle dependent	Attachment to Rack per ISIS Spec •64 lb within cg constraints
Power	5, 10, 15, or 20 Amp at 28 VDC	5, 10, 15, or 20 Amp at 28 VDC
Thermal Control Air	Nominal 150 W (1200 W rack maximum)	Nominal 150 W (1200 W rack maximum)
Thermal Control Water	500 W Heat Rejection per position (2 positions per rack)	500 W Heat Rejection per position (2 positions per rack)
Data	•1 - RS-422 •2 - +/- 5 Vdc Analog •1 - Ethernet •3 - 5 Vdc Discrete (bi-dir)	•1 - RS- 422 •1 - +/- 5 Vdc Analog •1 - Ethernet •2 - 5 Vdc Discrete (bi-dir)
Video	NTSC/RS 170A feed from payload source (Shared)	NTSC/RS 170A feed from payload source (Shared)
Venting	1 payload interface per rack (Shared)	1 payload interface per rack (Shared)
Nitrogen	1 payload interface per rack (Shared, 12 lbm/hr)	1 payload interface per rack (Shared, 12 lbm/hr)

Reference: EXPRESS Rack Payloads Interface Definition Document, SSP 52000-IDD-ERP



EXPRESS Rack Drawer





MSG Facility Hardware Overview



Removable Side Ports

16" diameter on both Left and Right sides for setting up hardware in Work Volume

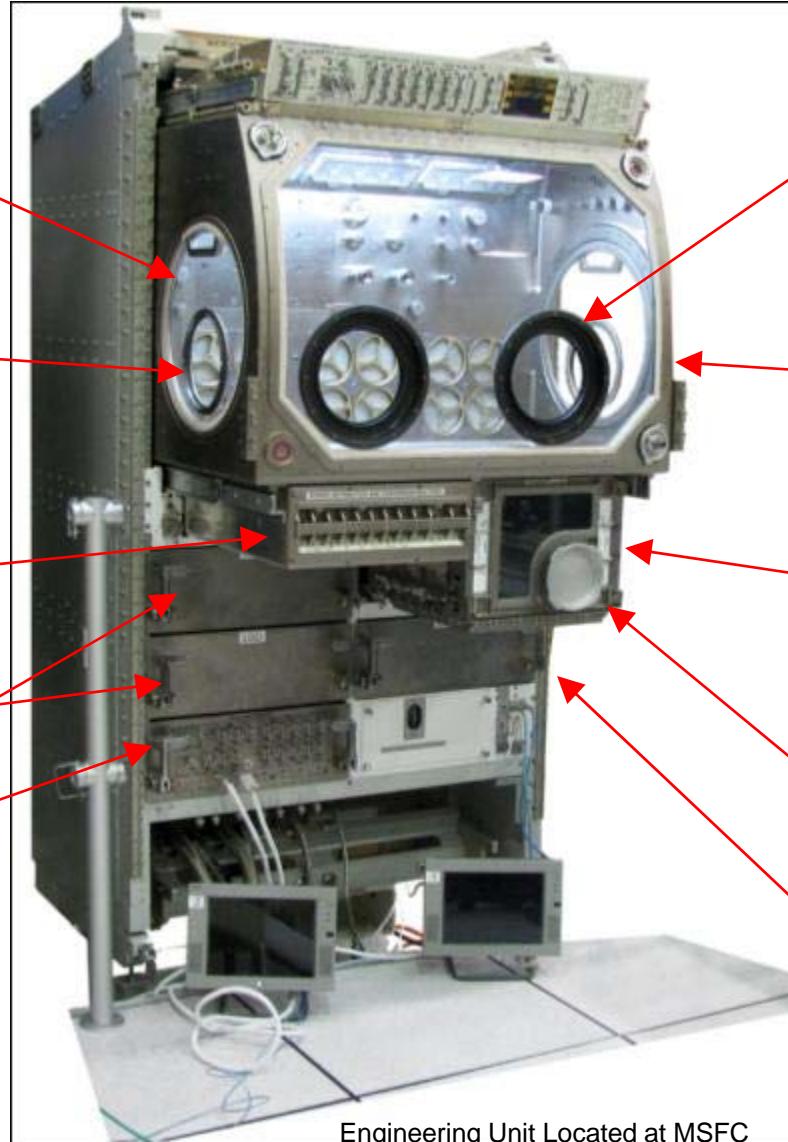
Glove Ports

Four identical glove ports are located on the left and right side loading ports and the front window

DC Power Switching And Circuit Breakers

Stowage Drawers

Video System Drawer



Front Window Glove Ports

Four 6" diameter glove ports can be fitted with any of three different sized gloves or blanks

Core Facility

Retractable Core Facility includes the Work Volume, Airlock, Power Distribution & Switching Box, and the Command and Monitoring Panel

Airlock

Provides a "Pass Through" for hardware to enter the Work Volume without breaking Containment. The lid of the Air Lock opens up into the floor of the Work Volume

Airlock Glove Port with Blank

A Single 4" diameter glove port can also be fitted with any of three different sized gloves or a blank

Stowage Drawers



Current MSG-Provided Payload Interfaces/Resources



- **Work Volume(WV) - Volume**
 - $0.255 \text{ m}^3 = 255 \text{ liters}$
- **Work Volume - Dimensions**
 - 906mm wide x 637mm high
 - 500mm deep (at the floor)
 - 385mm deep (at the top)
- **Maximum size of single piece of equipment in WV (via side access ports)**
 - 406mm diameter
- **Payload Attachment**
 - M6 threaded fasteners in floor, ceiling, & sides
- **Power available to investigation**
 - +28V DC at useable 7 amps
 - +12V DC at useable 2 amps
 - -12V DC at useable 2 amps
 - +5V DC at useable 4 amps
 - +120V DC at useable 8.3 amps
- **Maximum heat dissipation**
 - 1000W Total
 - 800W from coldplate
 - 200W from air flow
- **General illumination**
 - 1000 lux @ 200mm above WV floor
- **Video**
 - 4 color Hitachi HV-C20 cameras
 - 2 Sony DSRV10 Digital Recorders
 - 2 Sony GV-A500 Analog 8mm Recorders
- **Data handling connections**
 - Two RS422-to-MSG for investigations
 - One MIL-BUS-1553B-to-MSG for communication via MLC
 - Ethernet LAN 1 and LAN 2 (in US LAB)
 - MSG Laptop Computer (MLC) – IBM T61P
- **Filtration**
 - 12 HEPA/charcoal/catalyst WV filters
- **1 HEPA/charcoal/catalyst Airlock filter**
- **Up to Two Levels of Containment**
 - Physical barrier of MSG structures, gloves, etc.
 - Negative pressure generated by MSG fans.
- **Other resources available**
 - Gaseous Nitrogen
 - Vacuum (VRS & VES)



Light Microscopy Module





Light Microscopy Module



The microscope can house many different lenses corresponding to magnifications of 2.5, 4, 10, 20, 40, 50, 63 (air), 63 and 100 oil-coupled objectives.

Present capabilities include brightfield, fluorescence, and epi-illumination microscopy.

Future planned capabilities include high-resolution color video microscopy, condenser assembly, confocal microscopy, and possibly laser tweezers.

Fluorescence microscope



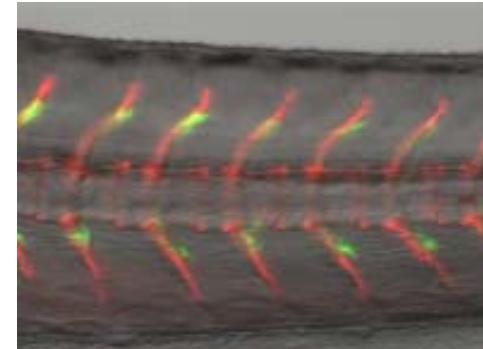
◆ Specifications

- Inverted microscope: Leica DMI 6000B
- Bright field, phase contrast, and fluorescence observations
- Objective lens: x5 (NA 0.12), x10 (NA 0.25), x20 (NA 0.35), x20 (NA 0.70), x40 (NA 0.50), x40 (NA 0.75)
- Monochrome CCD camera: Leica 360FX
- GFP and DsRED observations
- LED illumination (365, 470, 530, 620nm): Leica SFL7000
- Time-lapse videomicroscopy
- Leica micro-titer plate holder (No. 11531434) is set as a standard specimen holder.
- The maximum size of the specimen vessel including frame or holder is 83x127mm (micro-titer plate size)
- Objective lens, CCD camera, fluorescence filter cube, and LED illumination are exchangeable to Leica series

◆ Launched with HTV-3 in 2012, and onboard check out has been completed.



JAXA Microscope in MSPr



Medaka transgenic line